EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS

A THESIS SUBMITTED TO THE BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT (PUNJAB)

FOR THE AWARD OF DEGREE OF

MASTER OF SURGERY

IN

GENERAL SURGERY

BY

DR. PALAK GUPTA

SUPERVISOR

DR. CHIRANJIV SINGH GILL

DEPARTMENT OF GENERAL SURGERY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA
(MAY, 2020)

DECLARATION

I declare that the thesis entitled "**EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS**" has been prepared by me under the guidance of **Dr. Chiranjiv Singh Gill**, Professor, Department of General Surgery, Dayanand Medical College and Hospital, Ludhiana. No part of this thesis has formed the basis for the award of any degree previously.

Dr. Palak Gupta
Department of General Surgery
Dayanand Medical College & Hospital
Tagore Nagar
Ludhiana-141001
Punjab.

Date:

CERTIFICATE

I certify that **Dr. Palak Gupta** has prepared her thesis entitled "**EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS**" for the award of the degree of M.S. in General Surgery of Baba Farid University of Health Sciences, under my guidance. She has carried out the work at the Department of General Surgery, Dayanand Medical College & Hospital, Ludhiana.

Supervisor

Dr. Chirnajiv Singh Gill
Professor
Department of Surgery
DMC&H, Ludhiana

Co- supervisor

Dr. Varun Gupta
Associate Professor
Department of Surgery
DMC&H, Ludhiana

Date:

ENDORSEMENT BY THE HEAD OF THE DEPARTMENT AND PRINCIPAL

This is to certify that the thesis entitled "**EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS**" is a bonafide research work done by **Dr. Palak Gupta** under the guidance of **Dr. Chiranjiv Singh Gill**, Professor, Department of General Surgery, Dayanand Medical College & Hospital, Ludhiana.

Head of Department

Dr. Jaspal Singh
Professor & Head
Department of General Surgery
DMCH, Ludhiana

Principal

Dr. Sandeep Puri
Principal and Professor
DMCH, Ludhiana

Date:

COPYRIGHT

Declaration by the Candidate

I hereby declare that the Baba Farid University of Health Sciences, Faridkot, shall have the rights to preserve, use and disseminate this thesis in print or electronic format for academic/research purpose.

Dr. Palak Gupta
Department of General Surgery
Dayanand Medical College & Hospital
Tagore Nagar
Ludhiana-141001
Punjab.

Date:

© Baba Farid University of Health Sciences, Faridkot

Dedicated

to

my family

&

Teachers

ACKNOWLEDGEMENT

I bow with reverence, all humility and gratitude to thank The Almighty for giving me the opportunity to undertake this work and the ability to successfully complete it. Mere words are insufficient to express adequately my profound indebtedness and deep gratitude to my most revered teacher and illustrious guide ***Dr. Chiranjiv Singh Gill****, Professor, Department of General Surgery, D.M.C, Ludhiana, India. His unconditional help, affectionate guidance and fervent personal interest from the very inception of the study has contributed more to the accomplishment of my task than my over diligence and devotion. It has been a matter of great pride and privilege for me to have worked under the able guidance of this renowned teacher. His meritorious supervision, everlasting inspiration and invaluable encouragement at every step, helped me a lot. I owe him, a lifelong gratitude.*

I find myself short of words to express my gratefulness to my co-guide ***Dr. Varun Gupta****, Associate Professor, Department of General Surgery, D.M.C, Ludhiana, India. His limitless patience, crucial and timely advice and meticulous supervision at every step of this study have been a constant source of encouragement to me. I am highly grateful for his invaluable guidance to achieve academic excellence in my ongoing Post- graduate course.*

Heartiest thanks to ***Dr. Jaspal Singh****, Professor & Head, Department of General Surgery, D.M.C, Ludhiana, India, who helped me at every step of this curriculum with his valuable suggestions, tireless pursuit, guidance, great care and attention that he has willingly shown in the preparation of this library dissertation.*

I am obliged to all my teachers in the department ***Dr. Atul Mishra, Dr. Prabhdeep Singh Nain, Dr. Sanjeev Singla, Dr. Ravinderpal Singh,***

Dr. Amandeep Singh Nar, Dr. Ashish Ahuja, Dr. Munish Trehan , Dr. Ashvind Bawa*. who have always helped me in my difficult times. I am very thankful to my seniors for their constant guidance and support.*

It is my sacred duty to express my gratitude to my parents, ***Mr. Manish Gupta and Mrs. Rajita Gupta*** *and* ***Dr. Anup Bowry and Mrs. Shally Bowry*** *whose sacrifices, care and patience can never be repaid. Their understanding attitude, constant support, perseverance and presence have been the guiding light of my life that helped me reach where I am today. I am highly indebted to my brother* ***Mr. Puneet Gupta*** *and my sister* ***Dr. Apoorva Bowry*** *for their constant guidance and support.*

I am really thankful to my husband ***Dr. Rohan Bowry*** *for his unconditional support. His patience, guidance and wise advises have helped me survive the hardships of this course and made it easier for me to sail through this process smoothly. I am forever indebted to him for his support.*

I am thankful to my colleagues ***Dr. Tanya Bhalla, Dr. Ishan Chanana, Dr. Loveleen Garg*** *for their unflinching help during this endeavour. I also want to thank my every helping and generous juniors for their ever-ready help.*

Dr. Palak Gupta

ABSTRACT

Introduction: Acute Appendicitis, Is the most common surgically correctable cause of abdominal pain, the diagnosis of which remains difficult in many instances and Is essentially clinical. However a decision to operate based on clinical suspicion can lead to removal of normal appendix in 15-30% cases. Several diagnostic scoring systems have been devised as an aid to early diagnosis of acute appendicitis. This present study is attempted to evaluate the efficiency of appendicitis inflammatory response score in the pre-operative diagnosis of acute appendicitis.

Aim: To study the efficacy of appendicitis inflammatory response score in the diagnosis of acute appendicitis and its correlation with the operative and histopathological findings.

Material & Methods: The observational prospective study was conducted comprising patients who presented within one and a half year that is from 1st Jan 2018 to 30th June 2019 with provisional diagnosis of acute appendicitis and warranted surgery for the same.

Results: Appendicitis, being histopathologically proven in 54 patients at AIR score of ≥ 5. AIR score ≥5 were 2.13 times more likely to have appendicitis. The probability of having appendicitis when AIR score is ≥5 was 92% (Positive Predictive Value). Diagnostic accuracy of AIR score is 81.25%.

Conclusion: Appendicitis Inflammatory Score has high sensitivity and Positive Predictive Value in the diagnosis of acute appendicitis. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendectomy rate. In the diagnosis of acute appendicitis AIR score is a fast, simple, reliable, non-invasive, repeatable, safe complimentary aid without extra expense and complications. It is very handy in day care hospitals or peripheral hospitals where back up facilities like USG scan or CT scan is not available all the time.

Keywords: appendicitis, inflammatory, operative, histopathological.

TABLE OF CONTENTS

S. NO.	TOPIC	PAGES
I	INTRODUCTION	1-5
II	AIMS AND OBJECTIVES	6
III	REVIEW OF LITERATURE	7-18
IV	MATERIAL AND METHODS	19-20
V	OBSERVATIONS AND RESULTS	21-26
VI	DISCUSSION	27-31
VII	SUMMARY AND CONCLUSION	32
VIII	BIBLIOGRAPHY APPENDICES – I - PROFORMA - MASTER CHART	33-39
	APPENDICES – II - APPROVAL LETTER OF THESIS PLAN - THESIS PLAN	

LIST OF TABLES

Table No.	Title	Page No.
1	Appendicitis Inflammatory Response Score (AIRS): This scoring system consists of 2 symptoms, 1 sign and 4 laboratory values as follows	21
2	Gender wise distribution of appendicitis patients	22
3	Mean age of patients	23
4	Distribution of total study population into various risk groups on the basis of Appendicitis Inflammatory Response Score	24
5	Correlation of AIR score with histopathology	25
6	Statistical analysis	26

LIST OF FIGURES

Fig. No.	Title	Page No.
1	Gender wise distribution of appendicitis patients	22
2	Mean age of patients	23
3	Distribution of total study population into various risk groups on the basis of Appendicitis Inflammatory Response Score	24
4	Correlation of AIR score with histopathology	25

INTRODUCTION

Acute abdominal pain is the commonest complaint among emergency department patients. Diagnostics of one of the most common pathologies behind acute abdominal pain is acute appendicitis.[1-3] Acute appendicitis is also the most common reason for emergency abdominal surgery and has a lifetime risk of 7-8%. It is most commonly seen in the younger population with a male preponderance. Its incidence rises from birth and peaks in the late teen years, while gradually declining in the elderly age group. Appendicitis can progress to perforation, which is highly associated with a much higher morbidity and mortality, and surgeons are therefore inclined to operate when the diagnosis is probable rather than wait until it is certain.[4]

Abdominal pain, fever, and anorexia are classical symptoms. Pain first occurs in the upper abdomen from where it moves slowly and localizes to the right lower quadrant. In many of the cases, a fever of around 38°C is present.[5] Reginald Fitz was the first one, from Boston, who identified the inflammation of the appendix as a cause of right lower quadrant pain. He gave the term appendicitis and recommended an early surgical intervention.[6]

Doing a physical examination is the most useful method to diagnose appendicitis and to determine whether a surgical intervention is necessary. McBurney's, Lanz's, and Munro's points are the various points where tenderness can be elicited in the lower right quadrant of the abdomen. Among the indications for surgical treatment, the presence of peritoneal irritation is critical. Surgical intervention is indicated when Blumberg's sign is positive (the pain experienced by steadily increasing pressure at the site of tenderness and also increases on abrupt release of the pressure), and when Rosenstein's sign is elicited (tenderness in the right lower quadrant which increases when the patient changes the position from the supine to a recumbent on the left side). The detection of abdominal muscular guarding and tenderness on rectal examination are also the factors among the surgical indications.[5]

Robert Lawson performed first appendectomy in England.[7] Still 130 years later, acute appendicitis still remains the most common abdominal emergency, demanding surgical intervention. Mortality rate has improved with the advent of antibiotics since 1940. There is no perfect diagnostic evaluation tool which exists to detect appendicitis if symptoms are ambiguous. If the symptoms are vague, the diagnostic process takes longer, thus delaying the surgery and increasing the possibility of complications. Whereas, on the other hand, hasty operation without accurate diagnosis often leads to negative appendectomy, increasing the morbidity and cost of treatment.[8,9]

Even with the discovery of the modern diagnostic tools, misdiagnosis of appendicitis has been more or less constant. The percentage of misdiagnosis of appendicitis is higher among women than men. The various diagnostic approaches include symptomatology, physical examinations, laboratory findings and imaging modalities like ultrasonography and computerized tomography (CT) of abdomen.[6]

The development of imaging modalities, especially that of computed tomography (CT), has enabled more accurate diagnostics with a significant decrease in false positive diagnoses, which has led to lower rates of negative appendectomies.[10,11] This improvement in diagnostic accuracy has been achieved at the cost of exponentially increased use of imaging studies.[11]

With the routine use of ultrasonography (US), the negative laparotomy rate declined to approximately 10%.[12] With computed tomography (CT) and its higher sensitivity it has reduced the negative laparotomy rate, which has decreased even further to 5–10%.[12,13] In many of the European countries, most surgeons are still considering acute appendicitis to be a clinical diagnosis and do not perform imaging studies routinely.[14]

Imaging is associated with some risks as well. In the absence of diagnostic guidelines, imaging is often either over or underused. Overuse of imaging involves increased costs and increased risks of associated ionizing radiation and contrast medium, and a potential increased delay to treatment. Abdominal organs are sensitive to

ionizing radiation, and suspected appendicitis is most frequent in young patients for whom the considerations of radiation-induced risks are most important.[15-18]

After an initial uncontrolled increase in imaging, surgeons have successfully started to find ways of limiting the potentially harmful imaging without compromising diagnostic accuracy.[19-22]

Various scoring systems have been designed to aid in the clinical assessment of patients with acute appendicitis.[14] Diagnostic scoring was originally invented before the era of modern imaging technologies as an independent diagnostic tool. Scoring has therefore often been simply investigated in the surgical literature as an alternative to imaging.[23] However, scoring and imaging should optimally be used as complementary methods in a diagnostic algorithm. The aim is to achieve accurate diagnosis with minimal risks, delays, and costs in a standardized manner independent of the experience level of the clinician. Lately, diagnostic scoring has been included in consensus guidelines of diagnosis of appendicitis.[24,25]

Scoring systems have been valuable and valid instruments for differentiating between acute appendicitis and non-specific abdominal pain.[4] Various scoring systems have been designed for diagnosis of acute appendicitis. Among these Scoring systems, Alvarado system is hailed as simple to apply and efficacious. The Alvarado score involves a scoring system for diagnosing appendicitis has eight variables with total of 10 points. Alvarado scoring system has many drawbacks though; its construction was based on the review of patients who underwent surgery with doubt of appendicitis –based on a retrospective analysis. Whether each variable is statistically and independently relevant to acute appendicitis and valid as an inflammatory reaction variable is not accounted. The score does not involves C-reactive protein (CRP) as a variable, whereas various studies showed its importance in assessment of patients with appendicitis.[6] The recently introduced Appendicitis Inflammatory Response (AIR) Score was designed to overcome these drawbacks. This score incorporates the C-

reactive protein value in its design and was developed and validated on a prospective cohort of patients with suspicion of acute appendicitis.[14]

The Appendicitis Inflammatory Response (AIR) Score was published in 2008 and is similar to the Alvarado score in many aspects but emphasizes the inflammatory response laboratory results, and seems to perform better compared to the Alvarado score.[26,27] The Appendicitis Inflammatory Response (AIR) Score is a new scoring system that uses seven scored variables to stratify patients into Low, Intermediate, and High-risk groups. Ideally, the patients in the low-risk group can be discharged, and patients in the high-risk group can be directly scheduled for surgery. The patients in the intermediate risk group benefit most from further investigations such as imaging.[4]

Appendicitis Inflammatory Response Score consists of 2-symptoms, 1-sign and 4-laboratory values scored as follows:[6]

Appendicitis Inflammatory Response (**AIR score)**	
Vomiting	1
Pain in right lower quadrant	1
Muscular defence	
Light	1
Medium	2
Strong	3
Body temperature >38.5 0C	1
Polymorphonuclear leucocytes	
70-84%	1
Equal or more than 85%	2
WBC	
10000-14999 cells/mm^3	1
Equal or more than 15000/mm^3	2
CRP estimation	
10-49 mg/l	1
Equal or more than 50 mg/l	2

Appendicitis Inflammatory Response Score (AIR):[14]

- sum 0–4 = low probability
- sum 5–8 = indeterminate group
- sum 9–12 = high probability

In order to review the usefulness of Appendicitis Inflammatory Response (AIR) Score in cutting down the rate of negative appendectomy and also without increasing morbidity and mortality of patients, the present investigation was done to study the efficacy of Appendicitis Inflammatory Response Score in the diagnosis of acute appendicitis and its correlation with the operative and histopathological findings.

AIMS AND OBJECTIVES

To study the efficacy of appendicitis inflammatory response score in the diagnosis of acute appendicitis and its correlation with the operative and histopathological findings.

REVIEW OF LITERATURE

In the 1800s, the disease that is now known as appendicitis went by with several names including “peri-caecal inflammation”, “typhlitis”, “perityphlitis”, and “paratyphlitis”. Dr. Reginald Fitz first described appendicitis and suggested its treatment by early appendectomy in his article “Perforating inflammation of vermiform appendix” in 1886.[28] At that time, patients with generalized peritonitis usually died, whereas abdominal abscesses could be drained. Non operative treatment as we know today was practically non-existent with no intravenous fluids, antibiotics or vasopressors being available.[29]

In 1891, Charles McBurney published his article “The indications for early laparotomy in appendicitis”, where he described typical symptoms and findings of appendicitis. The important clinical symptoms and signs in McBurney’s article were the acute onset of abdominal pain, relocation of pain from the whole abdomen to the right iliac fossa, the maximal pain localization over the base of appendix, fever, tachycardia, and guarding. He described a focal point, later known as the “McBurney point”, where the pain from appendicitis is localized. He described the location of this point: “This point is very accurate in the adult from 1.5 to 2 inches inside of the right anterior superior spinous process of the ileus on a line drawn to the umbilicus”. When the etiology of abdominal pain was unclear, McBurney recommended observation and application of cold onto the abdomen.[30]

Before McBurney published his article on “the incision which was made in the abdominal wall in cases of appendicitis, with a new method of operating” in 1894, the surgery for appendicitis was performed through a midline incision or paramedian incision over the linea semilunaris.[31] The oblique incision used in open surgery for appendicitis through decades became known as the McBurney incision after the article although it was not originally invented by McBurney.[32] Mortality from appendicitis and appendectomy was high. After the era of McBurney and Fitz, the surgery for appendicitis remained technically

closely similar to modern open surgery, but development of hospitals and no operative treatment including antibiotics and anesthesia, together with better access to health care have made appendicitis a benign disease with a low mortality.

Clinical symptoms and signs already referred to by McBurney remained the cornerstone of diagnostics for decades. Blood leukocytosis and increased proportion of neutrophils were later found to be associated with appendicitis.[33] immediate surgery in order to prevent perforation was the gold standard, and false positive diagnosis of 15-30% was considered normal.[1]

The Appendicitis Inflammatory Response Score (AIRS) was reported by Andersson and Andersson in 2008.[26] This score was generated in Sweden by prospective data collection of 545 patients admitted with suspected appendicitis between October 1992 to December 1993. The score was developed from 316 randomly selected patients. The simplified score was constructed based on the ordered logistic regression. Eight variables with independent diagnostic value including right lower quadrant (RLQ) pain, rebound tenderness or muscle defense, white blood cell count, proportion of neutrophil, c-reactive protein (CRP), body temperature ≥ 38.5 degrees Celsius, and vomiting remained in the final model with score ranged from 0-12. The score 0-4 was classified as low probability and out patients follow up can be done if unaltered general condition. The score 5-8 was indeterminate risk and in hospital observation, re-evaluation, and further investigation were recommended. The score 9-12 was high probability and surgical exploration was proposed. The score was internally validated using 229 patients. The discrimination capacity of the score was better than Alvarado score in all appendicitis and advanced appendicitis samples. The ROC area of the new score came out to be 0.97 for advanced appendicitis and 0.93 for all other appendicitis cases compared with 0.92 ($p = 0.0027$) and 0.88 ($p = 0.0007$), respectively, for the Alvarado score. The various parameters like sensitivity, specificity, positive predictive value, and negative predictive value of the score with the cutoff point more than 4 were

0.96, 0.73, 0.64, and 0.97, respectively. The score were not externally validated in Asian population. This score needs external validation in Thai or Asian population and further evaluation in a prospective interventional study.

The technological development of imaging modalities followed, which improved diagnostic accuracy and thus the use of diagnostic imaging became popular in suspected acute appendicitis.[34] Today, the typical rate of false positive diagnosis is around 10% but great variation in this rate still exists. [34-36]

De Castro SMM et al in 2012[14] conducted a study to externally validate a recently developed appendicitis inflammatory response score and compared it to the Alvarado score. They included patients who presented with a doubt of acute appendicitis between 2006 and 2009. Parameters necessary to evaluate the scoring systems were noted. The diagnostic performance of both the scores was compared. 941 patients with suspicion of acute appendicitis were included. It included 410 male patients (44%) and 531 female patients (56%). The covered area under the receiver operating characteristic curve of the AIR score was 0.96 which was significantly better than the area under the Alvarado score curve of 0.82. The AIR score was better than the Alvarado score to analyze difficult patients which included women, children, and elderly. Therefore, AIR Score for patients with acute appendicitis is better than the Alvarado score.

Sammalkorpi HE et in 2014[37] conducted a study to construct a new scoring system for more accurate diagnosis of acute appendicitis. This prospective study involved 829 adults who presented with clinical suspicion of appendicitis, having 392 (47%) patients with appendicitis. The collected parameters had clinical findings and symptoms together with laboratory investigations such as WBC, PMN count and CRP levels and symptoms. The score was developed by logistic regression analysis using multiple imputations for missing values. The accuracy of the developed score in patients with whole data was compared with Alvarado score and Appendicitis inflammatory response (AIR) score. 47% of patients with whole data had appendicitis. 58% patients with

appendicitis had score of at least 16 and were labelled as high probability group with 93% specificity. Patients with lesser score than 11 had low probability of appendicitis. 4% of patients with appendicitis scored less than 11, and no one of them had complicated appendicitis. In contrast, 54% of patients with no appendicitis had score less than 11. There were nil cases with complicated appendicitis in the low probability group. The covered area under ROC curve was significantly larger with the new score compared with Alvarado score and Appendicitis inflammatory response (AIR) score. They concluded that this diagnostic score is fast and accurate in diagnosing patients with suspected appendicitis, and reduces the need of diagnostic imaging.

Schok T et al in 2014[38] conducted an observational prospective study to evaluate the added value of imaging in everyday clinical practice. All patients with suspected appendicitis were included at the emergency department of a Dutch teaching hospital during the period starting from September 2011 to May 2012 (n = 350; 237 adults and 113 children under 18 years). 21% of patients were not referred for imaging because of a low suspicion or alternative diagnosis. In 5% patients the guideline was not followed. 74% of patients underwent ultrasonography, 30% also underwent computed tomography. They concluded that when using imaging in the diagnosis of appendicitis, the percentage of negative appendectomies remains close to the percentage declared as unacceptable by the publishers of the guideline.

Scot AJ et al in 2015[39] assessed the potential benefits of risk stratification by the Appendicitis Inflammatory Response score to guide clinical decision-making. AIR score calculation, for all patients admitted with suspected appendicitis was done. On histological examination appendicitis was diagnosed, and patients were categorized as not having appendicitis pain if the histological findings were negative or surgical intervention was not done. The diagnostic use of the AIR score and the potential for risk stratification in reducing admissions, to optimize imaging and prevent unnecessary explorations were evaluated. Total of 464 patients were included, Out of which 210 (63·3

per cent) with non-appendicitis like pain were correctly classified as low risk. However, 13 low-risk patients had appendicitis. 48.1 per cent of admissions were Low-risk patients, 57% showed negative explorations and 50.7% of imaging requests (149 of 2694). Patients who had AIR score of 5 or more (intermediate and high risk) had high sensitivity for all complications of appendicitis (90 per cent) and also for advanced appendicitis (98 per cent). Patients who had AIR score of 9 or more were highly specific (97 per cent) for acute appendicitis, and the many of the patients with acute appendicitis falling in the high-risk group had perforation or gangrene. Ultrasound imaging did not exclude appendicitis in low-risk patients but helped in the diagnosing in intermediate-risk patients. CT helped in excluding appendicitis in low-risk patients and diagnosing appendicitis in the intermediate group. So, they found that AIR score is safe and reliable scoring system.

Von-Muhlen B et al in 2015[40] evaluated the AIR (Appendicitis Inflammatory Response) score for diagnosing and predicting the severity of acute appendicitis. Out of 273 patients who were evaluated, 126 were excluded who fell into exclusion criteria. All patients were submitted to AIR score. The value of the CRP and the percentage of WBC showed a direct relationship with acute appendicitis. Hence, the laboratory criteria, serum C-reactive protein and percentage of the polymorphonuclear leukocytes count were important to diagnosis and disease stratification.

Rathod S et al in 2015[41] evaluate the Raja Isteri Pengiran AnakSaleha Appendicitis (RIPASA) score in the diagnosis of acute appendicitis. It was a prospective study which undertook 100 cases presenting with the signs and symptoms suggestive of acute appendicitis. Validity of the RIPASA score was established by calculating its sensitivity, specificity, positive predictive value and negative predictive value including 95% confidence intervals using intraoperative diagnosis confirmed by histopathology. RIPASA had a sensitivity of 82.61% and a specificity of 88.89%. The positive predictive value was 96.61%, negative predictive value was 57.14% and a diagnostic accuracy rate of 83.91%. The RIPASA score is thus a

simple scoring system with reasonable sensitivity and specificity for the diagnosis of acute appendicitis.

Madasi V in 2016[42] compared the validity and reliability of Alvarado score and AIR score in diagnosis of appendicitis in a tertiary care teaching hospital. This was a prospective observational study conducted in a tertiary acre teaching hospital in south India, between July 2015 to August 2016, for 12 months. A total of 297 eligible subjects were included. For each patient Alvarado score and AIR score were calculated and compared with histopathological evaluation. The predictive validity of Alvarado score as assessed by area under the ROC curve was 0.74 as compared to 0.95 for AIR score. The sensitivity of the AIR score was 95.7% as compared to 87.3% sensitivity of ALVARADO score. AIR score had specificity of 90.5%, as compared to 52.4% for Alvarado score. Correspondingly, both false positive and false negative rates were higher for Alvarado score. The positive and negative predictive values of Alvarado score were 96% and 23.9%, as compared to 99.2% and 61.3% for AIR score. The overall diagnostic accuracy of Alvarado score was 85%, as compared to 95% for AIR score. The newly proposed appendicitis inflammatory response score had displayed a better validity and reliability, as compared to Alvarado score

Macco S et al in 2016[43] evaluated the Appendicitis Inflammatory Response score, Alvarado score, and Pediatric Appendicitis Score in children suspected of acute appendicitis. Data were collected retrospectively. All children younger than 18 years suspected of acute appendicitis who presented to the emergency department between Jan, 2006 and June, 2014 were included in this study. Variables were registered to evaluate 3 different appendicitis scoring systems. The diagnostic performance of the 3 scores was analyzed using the area under the receiver-operating curve and by calculating the diagnostic performances at different cut-off points. The study included 747 consecutive children. There were 399 boys (53%) and 348 girls (47%) with a mean age of 11 years (range, 1–17 years). In total, 269 children (36%) were diagnosed with acute appendicitis. The area under the

receiver-operating curve of the Appendicitis Inflammatory Response score was 0.90, the Alvarado score was 0.87, and the Pediatric Appendicitis Score was 0.82. The positive predictive value and specificity of the Appendicitis Inflammatory Response score were better at predicting an acute appendicitis than that of the Alvarado score and Pediatric Appendicitis Score. In children with a low-risk acute appendicitis, false negative rates of 14% for the Appendicitis Inflammatory Response, 7% for the Alvarado, and 18% for the Pediatric Appendicitis Score were measured. In this study, the Appendicitis Inflammatory Response score had the highest discriminating power and outperformed the Alvarado score and Pediatric Appendicitis Score in predicting acute appendicitis in children. Excluding acute appendicitis safely in children with the scoring systems still remains uncertain.

Tatar IG et al in 2016[44] evaluated the clinical Alvarado scoring system and computed tomography (CT) criteria for diagnosing acute appendicitis. A total number of 117 patients with acute abdominal pain who had undergone abdominal CT were enrolled in this retrospective study. The demographics, clinical Alvarado scoring, CT images, and pathologic results of the patients were studied. Out of 117, 39 of the 53 patients who were operated on, had pathologically proven acute appendicitis. The criteria of appendicitis on CT examination included appendiceal diameter, presence of peri-appendiceal inflammation, fluid, appendicolith, and white blood cell (WBC) count, which were significantly correlated with the inflammation of the appendix. The cut-off value for appendix diameter was 6.5 mm. The correlation between the appendix diameter and WBC count was 80%. The correlation between the appendix diameter and Alvarado score was 78.7%. The presence of CT criteria of appendix diameter above 6.5 mm, peri-appendiceal inflammation, fluid, and appendicolith should aid in the diagnosis of acute appendicitis. Since many patients with acute appendicitis may not always show the typical signs and symptoms, CT is a helpful imaging entity for patients with relatively low Alvarado score

and raised WBC's and when the physical examination is not conclusive.

Sammalkorpi HE et al in 2017[45] conducted a study to validate a recently described diagnostic scoring system, Adult Appendicitis Score (AAS), and evaluate its effects on negative appendectomy rate. Adult Appendicitis Score distributes patients into three groups: high, intermediate, and low risk of appendicitis. The score was used in diagnosis of adult patients who were suspected of acute appendicitis in two university hospitals. They analyzed the effects of Adult Appendicitis Score on diagnostic accuracy, imaging studies, and treatment. The study population was then compared with a reference population of 829 patients who were under suspicion of acute appendicitis were originally enrolled in the study for construction of the Adult Appendicitis Score. This study included 908 patients of whom 432 (48%) had appendicitis. The score separated 49% of all appendicitis patients into high-risk group having specificity of 93.3%. In the low-risk group, it was 7%. The histology also showed that negative appendectomy rate decreased from 18.2% to 8.7%, compared to the original dataset. Thus, Adult Appendicitis Score is a reliable tool and helps reducing negative appendectomy rates.

El-Shamy A in 2017[46] evaluated three scoring systems in children who were suspected to have acute appendicitis (Appendicitis Inflammatory Response score, Alvarado score, and Pediatric Appendicitis Score). 278 children with age less than 18 years old, suspicious to have acute appendicitis were involved in the study from 2013 to 2016. The various variables were recorded for subsequent evaluation of 3 different scoring systems pertaining to appendicitis diagnosis (Appendicitis Inflammatory Response score, Alvarado score, and Pediatric Appendicitis Score). The accuracy of diagnosing in each of the 3 scoring systems was checked by calculating the diagnostic performances at different cut-off points. 78 children (28%) had non-appendicitis cause of abdominal complaint and were eliminated from the study. A total of 200 patients underwent appendectomy. There were a total of 116 boys (58%) and 84 girls (42%) with a mean age of

8.6 years (range, 2.6–16.2 years). The accuracy, positive predictive value, sensitivity and specificity of the Appendicitis Inflammatory Response score were better than Alvarado and Paediatric appendicitis Scores in prognosis of acute appendicitis. In children having low-risk acute appendicitis, false negative rates were 2.2% for the Appendicitis Inflammatory Response, 4% for the Alvarado, and 9.7% for the Paediatric Appendicitis Score. Appendicitis Inflammatory Response (AIR) score classified 95.6% of all, confirmed on histological examination as acute appendicitis, to the high probability group compared with 85.9% with Alvarado score and with 83.4% with Paediatric Appendicitis Score. Appendicitis Inflammatory Response (AIR) scoring system is therefore the most convenient, accurate and specific scoring system for the paediatric Egyptian population suffering from acute appendicitis followed by Alvarado scoring system and lastly Paediatric Appendicitis scoring system. The Elimination of acute appendicitis safely in paediatric population with scoring systems still remains unreliable especially in female population.

Sudhir S et al in 2017[47] conducted a study to externally validate a newly developed scoring system that is appendix inflammatory response score, and to compare it with Alvarado score. They selected consecutive patients who presented to emergency department of J. S. S. Hospital, Mysore, with suspicion of acute appendicitis between September 2014 and September 2016. The variables necessary for evaluation were registered and diagnostic performance of two scores was compared. 200 patients with suspicion of acute appendicitis were included in their study. The results analyzed showed high specificity and negative predictive value for low-risk group (score 8), hence, proving it to be a better clinical score, when compared to Alvarado score in analyzing low-risk groups for appendicitis. They concluded that the appendix inflammatory response score has high specificity with high negative predictive value, thereby reducing negative appendicectomies in low-risk groups.

Singh A et al in 2017[48] conducted a study the pattern of RIPASA in cases of acute appendicitis. A prospective study was conducted in 100

patients reporting to surgery department with complaint of pain in right iliac fossa, suspected for acute appendicitis. RIPASA score was calculated preoperatively in all these patients and diagnosis further confirmed through operative findings. Out of 100, 70 patients were males and 30 patients were females. Majority of patients (76%) in this study group presented within first 48 hours of symptoms while 24% patients presents late after 48 hours of onset of symptoms. In this study out of 100 cases ultrasound was able to diagnose 90 cases while rest of 10 cases were diagnosed by CT scan. The sensitivity and specificity of RIPASA score were 90% and 92.22% respectively. They concluded that RIPASA score is simple and valuable tool for diagnosis of acute appendicitis and can help the surgeons to reduce the rate of negative appendicectomy.

Chae MS et al in 2017[49] evaluated the efficacy and diagnostic performance of various clinical scoring systems in adult patients with suspected appendicitis and suggestive CT findings. They retrospectively evaluated in all 189 adult patients with suggestive CT findings. Various Scoring Systems like Alvarado, Eskelinen, appendicitis inflammatory response(AIR), Raja Isteri Pengiran AnakSaleha Appendicitis (RIPASA), and adult appendicitis score (AAS) scores were evaluated, and the optimal, low, and high cut-off values were determined for patient classification into three groups: low, intermediate, or high. In all, 61 patients were included in the appendicitis group and 128 in the non-appendicitis group .No significant differences between the covered area under the curve of the clinical scoring systems in the final diagnosis of Acute Appendicitis for on CT. They concluded that the accuracy and efficacy of clinical scoring systems in the diagnosis of Acute Appendicitis with suggestive CT findings was moderate. Therefore, a high RIPASA score may assist in aiding the diagnosis of AA in patients with suggestive CT findings, and a low AAS score may be used as a criterion for patient discharge. Most of the patients presented with intermediate scores. The patients with suggestive CT findings may be considered as a third diagnostic category of AA.

Patil S et al in 2017[6] conducted a prospective study to compare appendicitis inflammatory response score (AIR) and Alvarado scoring systems in the suspected cases of acute appendicitis. 100 patients who presented with complaint of pain in the right lower quadrant of abdomen at the surgical clinic in Basaveshwar Teaching and General Hospital, Kalaburagi, Karnataka, India, who after undergoing clinical examination and relevant lab and radiological investigations were provisionally diagnosed to have acute appendicitis and warranted surgical intervention for the same , were evaluated using the scoring systems - Alvarado Score and Appendicitis Inflammatory Response Score. The scores were compared with final histopathological report. The results showed that AIR (at score >4) demonstrated a higher sensitivity and specificity compared to the Alvarado score. Alvarado showed a slightly better sensitivity at score>8. They concluded that Appendicitis Inflammatory Response Score was better than the Alvarado score.

Saha AK et al in 2018[4] conducted a study which included 100 patients presenting with pain in the abdomen, with a suspicion of acute appendicitis. Clinical evaluation was done and lab investigations were done and accordingly Appendicitis Inflammatory Response Score was calculated for each patient individually. The overall sensitivity of Appendicitis Inflammatory Response Score with score > 4 was found to be 89.9% and the overall specificity with score > 8 was found to be 100%. They found that The Appendicitis Inflammatory Response Score is a fast, simple, reliable, non-invasive, repeatable and safe diagnostic tool.

El-Mezayen MK in 2018[50] compared the AIR Score to the traditional Alvarado score to find out which is more accurate in the diagnosis of acute appendicitis. The study was carried out on 50 patients admitted to the surgical ER of Rashid General Hospital from December 2017 to April 2018 with complaints of pain in right lower quadrant between the age of 5 years old and 70 years old. All patients had right lower quadrant abdominal pain with doubt of having acute appendicitis, all of them were clinically examined and lab investigations done. Both

Alvarado Score and Appendicitis Inflammatory Response Score were calculated for all of them. Patients with moderate to high probability of having appendicitis underwent open appendectomy and then the histopathological examination of samples collected were done to confirm the diagnosis. It showed that, the 46 out of 50 patients had positive histological report; the AIR score had sensitivity of 95.65% while the Alvarado score had sensitivity of 91.3%. This study shows that the Appendicitis Inflammatory Response Score (AIR) appears to be more accurate than the Alvarado score.

Anwar HW et al in 2018[51] evaluated the appendicitis inflammatory response (AIR) score and compare its performance in predicting the risk of appendicitis to the Alvarado score. In this, 100 patients with right lower quadrant of abdomen pain, were admitted to The of Al-Hussain University Hospital. It included 52 females (52%) and 48 males (48%). Age ranging from 16 to 42 years old. The pregnant female cases, recurrent sub-acute appendicitis, abdominal malignancies or previous abdominal surgery were also excluded from the study. The study concluded that the AIR score is better than the Alvarado score.

MATERIALS AND METHODS

After institutional ethical committee clearance and written informed consent from patients, this observational prospective study was conducted comprising patients who presented within one and a half year that is from 1st Jan 2018 to 30th June 2019 with provisional diagnosis of acute appendicitis who attended the department of general surgery in Dayanand Medical College & Hospital, Ludhiana.

Source of Data

All patients, with the provisional diagnosis of Acute Appendicitis admitted in the wards and emergency in the department of surgery in the hospital Dayanand Medical College & Hospital, Ludhiana.

METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA

Patients with provisional clinical diagnosis of acute appendicitis

EXCLUSION CRITERIA

Patients presenting with non-right iliac fossa pain and those who had been admitted by other specialties for other complaints but subsequently developed right iliac fossa pain.

NUMBER OF CASES

The period of the study is one and a half year from 1st Jan 2018 to 30th June 2019.

METHODS OF COLLECTION

Patients of any age group and both genders who presented to the surgery department with pain in right lower quadrant of abdomen presenting with symptoms & signs of acute appendicitis were included in the study. All included patients admitted, initially were subjected for detailed history taking which includes symptoms & duration of the disease; General Physical Examination & Systemic Examination. Base-line investigations (full blood count, urine routine examination, USG Abdomen was done. Then a specially designed proforma was filled in for each patient. These proforma had general information about the patients, plus eight variables based on the Appendicitis inflammatory response score. Then the sum of all the scores is calculated for each

patient Diagnosis of acute appendicitis was confirmed by operative findings and histopathological assessment of the appendicectomy specimen. Finally the reliability of Appendicitis Inflammatory Response Score system was assessed by the intraoperative and histopathological findings. The findings were compared retrospectively with the Appendicitis Inflammatory Response Score.

After collecting the basic clinical data (name, age, gender, history and examination) and collecting the routine lab values), the Appendicitis Inflammatory Response Score was assigned to each of the patient.

STATISTICAL ANALYSIS

Data was described in terms of range; frequencies (number of cases) and relative frequencies (percentages) as appropriate. The sensitivity and specificity were calculated for the appendicitis inflammatory response score by comparing with the biopsy report after surgery**.** All statistical calculations were done using SPSS (Statistical Package for the Social Science) 17 version statistical program for Microsoft windows.

OBSERVATIONS AND RESULTS

This observational prospective study was conducted comprising of 64 patients with provisional diagnosis of acute appendicitis who attended the department of general surgery in Dayanand Medical College & Hospital, Ludhiana. After the documentation of the clinical impression, all the patients were further examined and investigated and Appendicitis Inflammatory Response Score was calculated for each patient and were grouped into three groups. Patients having Appendicitis Inflammatory Response Score from 0 to 4 were grouped into low, from 5-8 were grouped into intermediate and from 9-12 were grouped into high-risk group.

Table 1: Appendicitis Inflammatory Response Score (AIRS): This scoring system consists of 2 symptoms, 1 sign and 4 laboratory values as follows:

AIR Score Variables	Score
Vomiting	1
Pain In Right Lower Quadrant	1
Rebound Tenderness (or muscle guarding)	
Light	1
Medium	2
Strong	3
Body Temperature (>38.5˚C)	1
Polymorphonuclear Leucocytes	
(70-84) %	1
≥85 %	2
White Blood Cell Count	
(10,000-14,999) cells/cumm	1
≥ 15,000 cells/cumm	2
C-Reactive Protein Estimation	
(10-14) mg/l	1
≥ 50 mg/l	2

Table 2: Gender wise distribution of appendicitis patients

Gender	No. of patients (n=64)	Percentage (%)
Males	49	76.56%
Females	15	23.43%

Appendicitis is more common in males as compared to females.

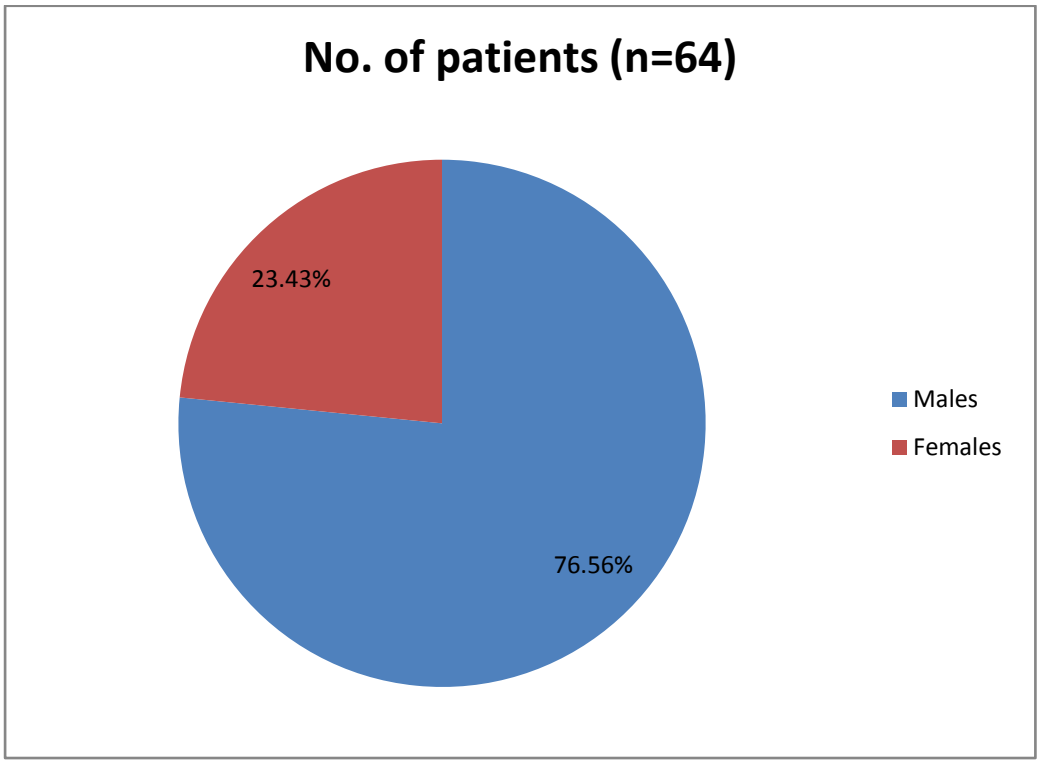

Figure 1: Gender wise distribution of appendicitis patients

Table 3: Mean age of patients

Gender	Mean age of patients	Minimum age	Maximum age
Males (n=49)	36.95±17.91	8	74
Females (n=15)	34.66±16.10	7	65
Overall patients (n=64)	36.42±17.41	7	74

Overall mean age for occurrence of appendicitis is 36.42 years. Mean age in males is 36.95 years and mean age in females is 34.66 years.

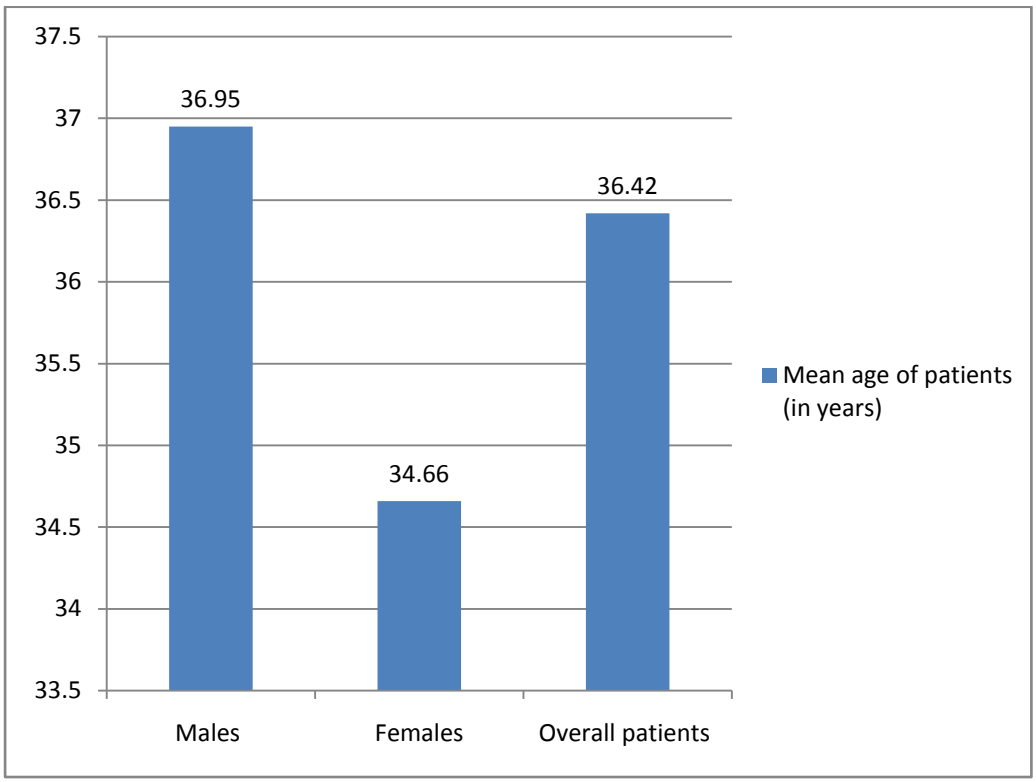

Figure 2: Mean age of patients

Table 4: Distribution of total study population into various risk groups on the basis of Appendicitis Inflammatory Response Score

AIR score based risk group	No. of patients (n=64)	Percentage
Low(1-4)	13	20.31%
Intermediate (5-8)	33	51.56%
High (9-12)	8	12.5%

Maximum patients that are 51.56% were in the intermediate risk group on the basis of Appendicitis Inflammatory Response Score.

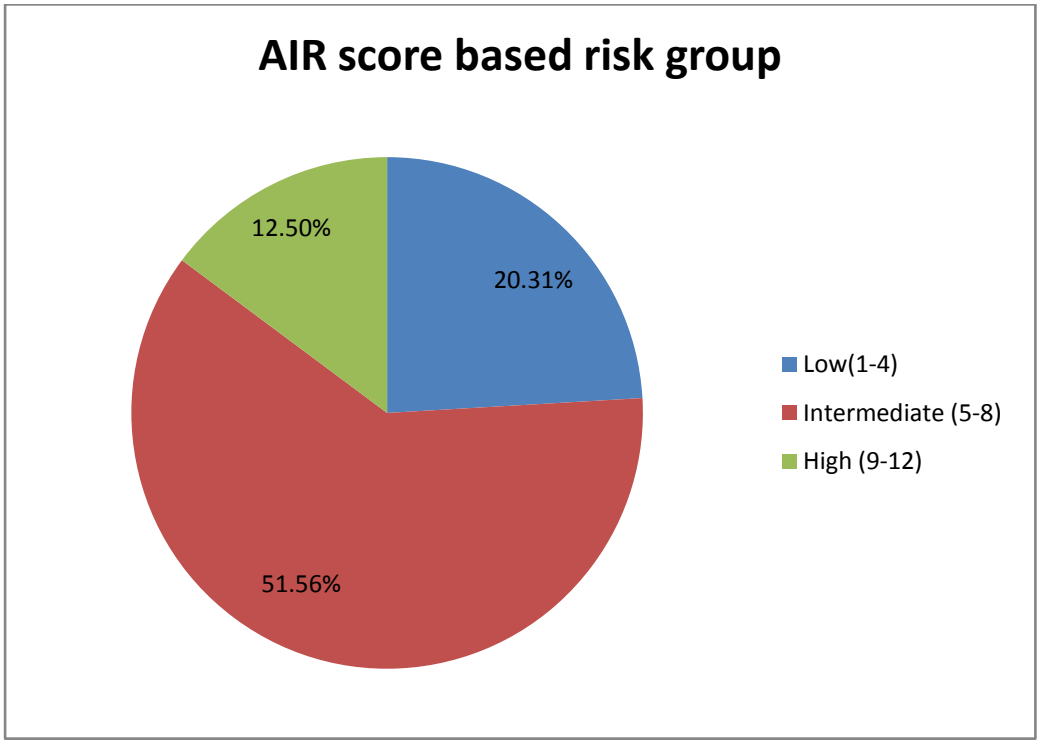

Figure 3: Distribution of total study population into various risk groups on the basis of Appendicitis Inflammatory Response Score

Table 5: Correlation of AIR score with histopathology

AIR SCORE	Appendicitis present (n=54)	Appendicitis absent (n=10)
<5	8	6
≥5	46	4

On histopathological diagnosis appendicitis was present in 54 patients. 8 patients had AIR score <5 and 46 patients had AIR score ≥5. Appendicitis was absent in 10 patients. 6 patients had AIR score l <5 and 4 patients had AIR score ≥5.

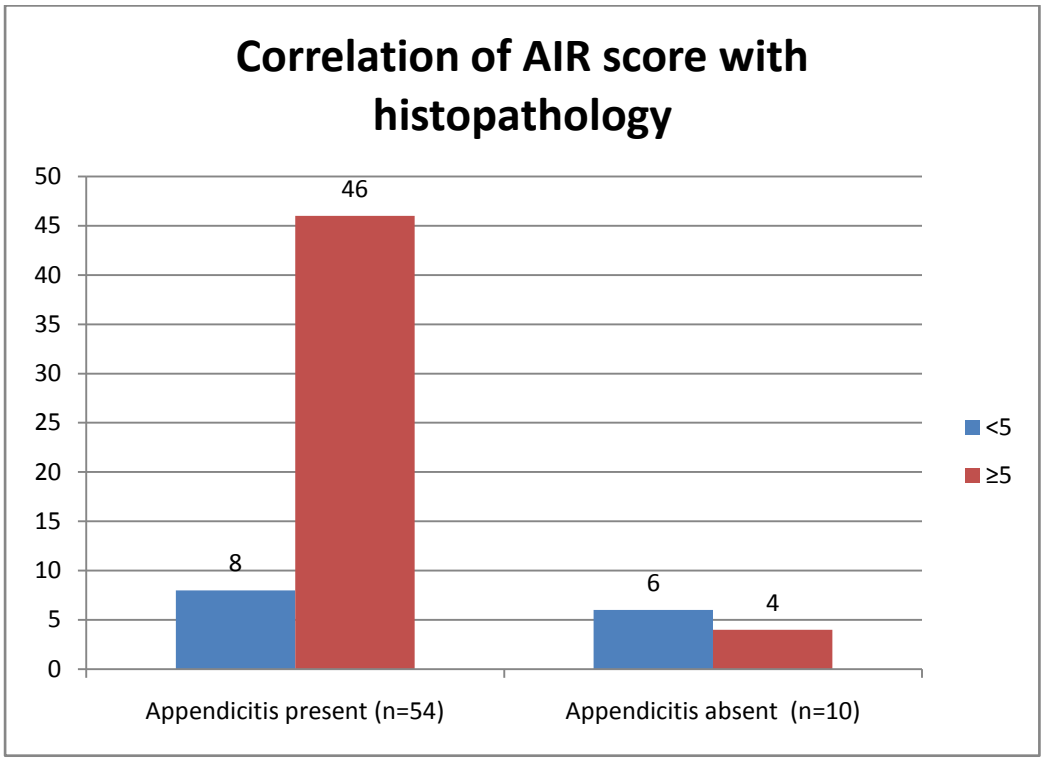

Figure 4: Correlation of AIR score with histopathology

Table 6: Statistical analysis

Statistic	Value	
	(n=64)	95% CI
Sensitivity	85.19%	72.88% to 93.38%
Specificity	60.00%	26.24% to 87.84%
Positive Likelihood Ratio	2.13	0.99 to 4.59
Negative Likelihood Ratio	0.25	0.11 to 0.56
Disease prevalence	84.38%	73.14% to 92.24%
Positive Predictive Value	92.00%	84.23% to 96.12%
Negative Predictive Value	42.86%	24.91% to 62.90%
Accuracy	81.25%	69.54% to 89.92%

AIR score had optimum cutoff point of score value <5 with sensitivity 85.19% and specificity 60%. Positive Likelihood Ratio is 2.13. Hence, those who have AIR score ≥5 were 2.13 times more likely to have appendicitis. The probability of having appendicitis when AIR score is ≥5 was 92% (Positive Predictive Value). Diagnostic accuracy of AIR score is 81.25%.

DISCUSSION

Surgery for acute appendicitis is one of the most common emergent procedures in general surgery. The overall lifetime risks of developing acute appendicitis are 8.6% and 6.7% for males and females, respectively;[52] lifetime risks of undergoing an appendectomy are around 12% and 23% in males and females, respectively.[53] A deferral in playing out an appendectomy with a specific end goal to enhance diagnostic precision leads to the danger of appendicular perforation and infection, which enhances the morbidity and the mortality.[54] The inverse is also valid, where with lessened demonstrative accuracy, the negative or unessential appendectomy rate is expanded, and this is described to be roughly 20%–40%.[55] Diagnostic modalities such as ultrasonography or CT imaging in developing countries may raise the cost of healthcare considerably. Unselective use of CT may lead to early appendicitis and needless appendectomies involving patients whose appendicitis might have been improved naturally through the use of antibiotics.[56]

A study on malpractice lawsuits from North America found that appendicitis ranks third among lawsuits, even though appendicitis is the cause of acute abdominal pain only about 5% of the time or less. An objective validated scoring system could legally strengthen decisions made in the emergency room and could avoid malpractice liability. Most claims involve misdiagnosis or delayed diagnosis, and common pitfalls include poor documentation.[57]

A clinical scoring system estimates the probability of appendicitis in a patient and should aid in the decision making process for treatment because of its simple design and application. There are a number of reasons to use scoring systems in managing cases of appendicitis. A clinical score may be suitable as an instrument for selecting patients for immediate surgery, further examination with imaging techniques, or observation. The score can be repeated during active observation and influence the decision to operate. It must be emphasized that the intent of the scoring system is not to establish a primary diagnosis of

appendicitis, but simply to discriminate objectively when there is uncertainty.[14]

A number of clinical scoring systems has been used as complimentary aid in diagnosis of acute appendicitis. The AIR scoring system is another clinical criterion used for diagnosis of acute appendicitis and has been well known in validation studies during the last decade.[14,26]

We conducted an observational prospective study comprising of 64 patients with provisional diagnosis of acute appendicitis who attended the department of general surgery in Dayanand Medical College & Hospital, Ludhiana. After the documentation of the clinical impression, all the patients were further examined and investigated and Appendicitis Inflammatory Response Score was calculated for each patient and were grouped into three groups. Patients having Appendicitis Inflammatory Response Score from 0 to 4 were grouped into low, from 5-8 were grouped into intermediate and from 9-12 were grouped into high-risk group.

In our study Appendicitis is more common in males as compared to females. 76.56% of the males and 23.43% of the females had appendicitis. The findings of our study are consistent with the studies done by Sulu B et al[58] in which appendicitis was more common in males (53.5%) as compared to females (46.5%). Saha AK et al[4] reported that appendicitis is more common in males (68.5%) as compared to females (31.5%). Madasi V[42] in their study also reported that appendicitis is more common in males (54.90%) as compared to females (45.10%).

Overall mean age for occurrence of appendicitis is 36.42 years. Mean age in males is 36.95 years and mean age in females is 34.66 years. The youngest patient reported in our study is 7 years old female and eldest patient reported in our study is 74 years old male. Patil S et al[6] reported that overall mean age for occurrence of appendicitis is 28.9 years. Mean age in females being 27.2 years and in males 29.8 years, with range in both sexes being 9 to 72 years. Saha AK et al[4] reported maximum cases of appendicitis are found to occur in ≤ 30years of age (78.6%). Scott AJ et al[39] in their study found that the mean age of

appendicitis was 27 years.

Maximum patients that are 51.56% were in the intermediate risk group on the basis of Appendicitis Inflammatory Response Score. 12.5% of the patients were in low risk group and 20.31% patients were in high risk group. Saha AK et al[4] also divided the study population into various risk group on the basis of Appendicitis Inflammatory Response Score. They found that maximum patients were in intermediate group (73%) followed by low risk (16%) and high risk (11%). Madasi V[42] et al divided the patients into high risk and low risk and found that 84.50% 0f patients were in high risk group and 10.40% of patients were in low risk group.

The most common symptom in our study is pain. All patients complained about having pain in right lower quadrant. Apart from pain the most common symptom observed is vomiting, which is found in 74.07% of appendicitis patient. Our findings are similar to the study done by Saha AK et al[4] who reported vomiting in 77.5% of patients. Patil S et al[6] found that 74% of patients had vomiting. The findings of our study are higher to the findings of Kariman H et al[59] in which 61% of individuals were found to have nausea and vomiting.

Temperature is raised in 75.92% of patients. Similar findings were also noted by Lin et al[16] in which the frequency of fever in appendicitis group was comparatively higher than the non-appendicitis group (43.4% vs 17% respectively). Saha AK et al[4] found that temperature is raised in 64 % of appendicitis patients. Von-Muhlen B[40] reported that axillary temperature went up beyond 38.5ºC in just 27.9% of patients.

Leucocytosis in this study was found to be in 92.59% of patients which is higher than the percentage reported by Saha AK et al[4] (63%) Patil S et al[6] (61%) and Kim BS et al[60] (72%).

We evaluated the efficiency of Appendicitis Inflammatory Response Score on the basis of sensitivity, positive predictive value and accuracy.

On histopathological diagnosis appendicitis was present in 54 patients. 8 patients had AIR score <5 and 46 patients had AIR score ≥5. Appendicitis was absent in 10 patients. 6 patients had AIR score l <5

and 4 patients had AIR score ≥5.

Our study calculated the sensitivity, the specificity, the positive likelihood ratio, the negative likelihood ratio, the positive predictive value, the negative predictive value and accuracy of AIR score.

The true positive rate (sensitivity) is the proportion of actual positives that are appropriately recognized; this is the percentage of sick people who are properly diagnosed as having appendicitis. The true negative rate (specificity) is the proportion of negatives that are properly recognized; this is the percentage of healthy people who are correctly recognized as not having appendicitis.[61] The positive predictive value and the negative predictive value are the proportion of patients with positive criteria who really have the disease and the proportion of patients with negative criteria who are actually free of the disease, respectively. The likelihood ratio (LR) demonstrates how likely other people are to get positive criteria if they have the disease compared with a person without disease. The PLR is usually a number greater than one, and the NLR ratio is usually a number smaller than one.[62-64]

In present study AIR score had optimum cutoff point of score value <5 with sensitivity 85.19% and specificity 60%. The positive likelihood ratio is 2.13, the negative likelihood ratio is 0.25, the positive predictive value is 92%, the negative predictive value is 42.86% and diagnostic accuracy of AIR score is 81.25%.

The findings of our study are similar to study conducted by Saha AK et al[4] who reported (at score >4) Sensitivity of AIR score of 89.9% and specificity 63.6%. The positive predictive value is 95.23%, the negative predictive value is 43.75%.

The sensitivity of Appendicitis Inflammatory Response Score is comparatively lower than Andersson M. and Andersson RE[26] who classified 63% of the patients into the low or high probability group with an accuracy of 97.2%, leaving 37% for further investigation. In their study 73% of the non appendicitis patients, 67% of the advanced appendicitis, and 37% of all appendicitis patients were correctly classified into the low- and high probability zone, respectively.

In the study done by Scott AJ et al[39] an AIR score of 5 or more

demonstrated high sensitivities for intermediate and high risk patients with appendicitis (90%) and for patients with advanced appendicitis (98%).

Kollar D et al[27] in their study gave final diagnosis of Appendicitis in 67 of 182 patients (37%). In their study AIR score was assigned in a smaller proportion of patients to the high probability zone with specificity of 97% and positive predictive value of 88%.

Madasi V[42] in their study reported that the sensitivity of the AIR score was 95.7% and specificity of 90.5%. The positive and negative predictive values were 99.2% and 61.3% for AIR score. The overall diagnostic accuracy of AIR score was 95%.

The present study shows that the AIR score has a good statistical discrimination for patients with acute appendicitis. The discriminatory property of the AIR score remains high in the diagnosis of patients. Nowadays, the use of US or CT in patients suspected of having appendicitis is common. However, imaging does not perform well in patients with low and high prevalence of the disease, and CT should be used selectively to minimize exposure to ionizing radiation. Moreover, false negative results may delay surgery and subsequently increase morbidity.

Furthermore, in developing countries like India scoring systems aid in diagnosis of appendicitis minimizing the routine use of investigations such as USG and CT.

SUMMARY AND CONCLUSION

- Appendicitis is more common in males as compared to females.
- Overall mean age for occurrence of appendicitis is 36.42 years. Mean age in males is 36.95 years and mean age in females is 34.66 years.
- Maximum patients that are 51.56% were in the intermediate risk group on the basis of Appendicitis Inflammatory Response Score.
- On histopathological diagnosis appendicitis was present in 54 patients. 8 patients had AIR score <5 and 46 patients had AIR score ≥ 5. Appendicitis was absent in 10 patients. 6 patients had AIR score <5 and 4 patients had AIR score ≥ 5.
- AIR score had optimum cutoff point of score value <5 with sensitivity 85.19% and specificity 60%.
- Diagnostic accuracy of AIR score is 81.25%.

CONCLUSION

Appendicitis Inflammatory Score has high sensitivity and Positive Predictive Value in the diagnosis of acute appendicitis. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendectomy rate. In the diagnosis of acute appendicitis AIR score is a fast, simple, reliable, non-invasive, repeatable, safe complimentary aid without extra expense and complications. It is very handy in day care hospitals or peripheral hospitals where back up facilities like USG scan or CT scan is not available all the time.

BIBLIOGRAPHY

1. Gilmore OJ, Browett JP, Griffin PH, Ross IK, Brodribb AJ, Cooke TJ, et al. Appendicitis and mimicking conditions. A prospective study. Lancet. 1975;2(7932):421-4.
2. Andersson RE, Hugander A, Thulin AJ. Diagnostic accuracy and perforation rate in appendicitis: association with age and sex of the patient and with appendicectomy rate. Eur J Surg. 1992;158(1):37-41.
3. Hoffmann J, Rasmussen OO. Aids in the diagnosis of acute appendicitis. Br J Surg. 1989;76(8):774-9.
4. Saha AK, Chatterjee TK, Sohail S, Saha N. "Evaluation of the Appendicitis Inflammatory Response Score for Patients with suspected Acute Appendicitis”.” IOSR Journal of Dental and Medical Sciences. 2018;17(2):40-44.
5. Ishikawa H. Diagnosis and Treatment of Acute Appendicitis. JMAJ. 2003;46(5):217-21.
6. Patil S, Harwal R, Harwal S, Kamthane S. Appendicitis inflammatory response score: a novel scoring system for acute appendicitis. Int Surg J. 2017;4:1065-70.
7. Seal A. Appendicitis: a historical review. Can J Surg. 1981;24:427-33.
8. Flum DR, Koepsell T. The clinical and economic correlates of misdiagnosed appendicitis: nationwide analysis. Arch Surg. 2002;137(7):799-804.
9. Blomqvist PG, Andersson RE, Granath F, Lambe MP, Ekbom AR: Mortality after appendectomy in Sweden, 1987-1996. Ann Surg. 2001;233(4):455-60.
10. Boonstra PA, van Veen RN, Stockmann HB. Less negative appendectomies due to imaging in patients with suspected appendicitis. Surg Endosc. 2015;29(8):2365-70.
11. Raja AS, Wright C, Sodickson AD, Zane RD, Schiff GD, Hanson R, et al. Negative appendectomy rate in the era of CT: an 18-year perspective. Radiology. 2010;256(2):460-5.

12. Cuschieri J, Florence M, Flum DR. Negative appendectomy and imaging accuracy in the Washington state surgical care and outcomes assessment program. Ann Surg. 2008;248:557-63.
13. Wagner PL, Eachempati SR, Soe K. Defining the current negative appendectomy rate: for whom is preoperative computed tomography making an impact? Surgery. 2008;144:276-82.
14. De Castro SMM, Unlu C, Ph. Steller CE, Van Wagensveld BA, Vrouenraets BC. Evaluation of the Appendicitis Inflammatory Response Score for Patients with Acute Appendicitis. World J Surg. 2012;36:1540-5.
15. Hall EJ, Brenner DJ. Cancer risks from diagnostic radiology: the impact of new epidemiological data. Br J Radiol. 2012;85(1020):e1316-7.
16. Brenner DJ, Hall EJ. Cancer risks from CT scans: now we have data, what next? Radiology. 2012;265(2):330-1.
17. Pritchett CV, Levinsky NC, Ha YP, Dembe AE, Steinberg SM. Management of acute appendicitis: the impact of CT scanning on the bottom line. J Am Coll Surg. 2010;210(5):699-705.
18. Lehtimaki T, Juvonen P, Valtonen H, Miettinen P, Paajanen H, Vanninen R. Impact of routine contrast-enhanced CT on costs and use of hospital resources in patients with acute abdomen. Results of a randomized clinical trial. Eur Radiol. 2013;23(9):2538-45.
19. Kharbanda AB, Madhok M, Krause E, Vazquez-Benitez G, Kharbanda EO, Mize W, et al. Implementation of Electronic Clinical Decision Support for Pediatric Appendicitis. Pediatrics. 2016;137(5):e20151745.
20. Shah SR, Sinclair KA, Theut SB, Johnson KM, Holcomb GW, St Peter SD. Computed Tomography Utilization for the Diagnosis of Acute Appendicitis in Children Decreases With a Diagnostic Algorithm. Ann Surg. 2016;264(3):474-81.
21. Adibe OO, Amin SR, Hansen EN, Chong AJ, Perger L, Keijzer R, et al. An evidence-based clinical protocol for diagnosis of

acute appendicitis decreased the use of computed tomography in children. J Pediatr Surg. 2011;46(1):192-6.

22. O'Malley ME, Alharbi F, Chawla TP, Moshonov H. CT following US for possible appendicitis: anatomic coverage. Eur Radiol. 2016;26(2):532-8.
23. Apisarnthanarak P, Suvannarerg V, Pattaranutaporn P, Charoensak A, Raman SS, Apisarnthanarak A. Alvarado score: can it reduce unnecessary CT scans for evaluation of acute appendicitis? Am J Emerg Med. 2015;33(2):266-70.
24. Di Saverio S, Birindelli A, Kelly MD, Catena F, Weber DG, Sartelli M, et al. WSES Jerusalem guidelines for diagnosis and treatment of acute appendicitis. World J Emerg Surg. 2016;11:34.
25. Gorter RR, Eker HH, Gorter-Stam MA, Abis GS, Acharya A, Ankersmit M, et al. Diagnosis and management of acute appendicitis. EAES consensus development conference 2015. Surg Endosc. 2016;30(11):4668-90.
26. Andersson M, Andersson RE. The appendicitis inflammatory response score: a tool for the diagnosis of acute appendicitis that outperforms the Alvarado score. World J Surg. 2008;32(8):1843-9.
27. Kollar D, McCartan DP, Bourke M, Cross KS, Dowdall J. Predicting acute appendicitis? A comparison of the Alvarado score, the Appendicitis Inflammatory Response Score and clinical assessment. World J Surg. 2015;39(1):104-9.
28. Fitz RH. Perforating inflammation of the vermiform appendix with special reference to its early diagnosis and treatment. Am J Med Sci.1886;92:321-46.
29. Richardson WS. The evolution of early appendectomy as standard treatment from appendicitis: what we can learn from the past in adopting new medical therapies. Am Surg. 2015;81(2):161-5.
30. McBurney C. II. The Indications for Early Laparotomy in Appendicitis. Ann Surg. 1891;13(4):233-54.

31. McBurney C. IV. The Incision Made in the Abdominal Wall in Cases of Appendicitis, with a Description of a New Method of Operating. Ann Surg. 1894;20(1):38-43.
32. Grover CA, Sternbach G. Charles McBurney: McBurney's point. J Emerg Med. 2012;42(5):578-81.
33. Sasso RD, Hanna EA, Moore DL. Leukocytic and neutrophilic counts in acute appendicitis. Am J Surg. 1970;120(5):563-6.
34. Lahaye MJ, Lambergts DM, Mutsaers E, Essers BA, Breukink SC, Beets GL, et al. Mandatory imaging cuts costs and reduces the rate of unnecessary surgeries in the diagnostic work-up of patients suspected of having appendicitis. Eur Radiol. 2015;25(5):1464-70.
35. National Surgical Research Collaborative. Multicentre observational study of performance variation in provision and outcome of emergency appendicectomy. Br J Surg. 2013;100(9):1240-52.
36. Papes D, Srsen Medancic S, Antabak A, Sjekavica I, Luetic T. What is the acceptable rate of negative appendectomy? Comment on "Prospective evaluation of the added value of imaging within the Dutch National Diagnostic Appendicitis Guideline--do we forget our clinical eye"? Dig Surg. 2015;32(3):181-2.
37. Sammalkorpi HE, Mentula P, Leppaniemi A. A new adult appendicitis score improves diagnostic accuracy of acute appendicitis - a prospective study. BMC Gastroenterology. 2014;14:114.
38. Schok T, Simons PC, Janssen-Heijnen ML, Peters NA, Konsten JL. Prospective Evaluation of the Added Value of Imaging within the Dutch National Diagnostic Appendicitis Guideline - Do we Forget our Clinical Eye? Dig Surg. 2014;31:436-43.
39. Scot AJ, Mason SE, Arunakirinathan M, Reissis Y, Kinross JM, Smith JJ. Risk stratification by the Appendicitis Inflammatory Response score to guide decision-making in patients with suspected appendicitis. Br J Surg. 2015;102:563-72.

40. Von-Muhlen B, Franzon O, Beduschi MG, Kruel N, Lupselo D. Air score assessment for acute appendicitis. Arq Bras Cir Dig. 2015;28(3):171-3.
41. Rathod S, Ali I, Bawa AP, Singh G, Mishra S, Nongmaithem M. Evaluation of Raja Isteri Pengiran Anak Saleha Appendicitis score: A new appendicitis scoring system. Med J DY Patil Univ. 2015;8:744-9.
42. Madasi V. Comparison of Predictive Validity of Alvarado Score and Appendicitis Inflammatory Response (AIR) Score, A Hospital Based Observational Study. Int J surg Orthopedics. 2016;2(3):29-34.
43. Macco S, Vrouenraets BC, De Castro SMM. Evaluation of scoring systems in predicting acute appendicitis in children. Surgery. 2016;160(6):1599-1604.
44. Gunes Tatar I, Yilmaz KB, Sahin A, Aydin H, Akinci M, Hekimoglu B. Evaluation of clinical Alvarado scoring system and CT criteria in the diagnosis of acute appendicitis. Radiology research and practice. 2016;2016:9739385.
45. Sammalkorpi HE, Mentula P, Savolainen H, Leppäniemi A. The Introduction Of Adult Appendicitis Score Reduced Negative Appendectomy Rate. Scandinavian Journal of Surgery. 2017;106(3):196-201.
46. El-Shamy A. Prognostication of Pediatric Appendicitis with Three Scoring Systems. Life Science Journal. 2017;14(6):17-24.
47. Sudhir S, Sekhar AP. Evaluation of Appendicitis Inflammatory Response Score as a Novel Diagnostic Tool for Diagnosis of Acute Appendicitis and its Comparison with Alvarado Score. IJSS Journal of Surgery. 2017;3(1):21-6.
48. Singh A, Kuka AS, Singh S, Kuka PS. To Study the Pattern of RIPASA (Raja Isteri Pengiran Anak Saleha Appendicitis) Score in Acute Appendicitis. International Journal of Contemporary Medical Research. 2017;4(1):236-40.
49. Chae MS, Hong CK, Ha YR, Chae MK, Kim YS, Shin TY, et al. Can clinical scoring systems improve the diagnostic accuracy in

patients with suspected adult appendicitis and equivocal preoperative computed tomography findings? Clin Exp Emerg Med. 2017;4(4):214-21.

50. El-Mezayen MK, Mahmoud AR, Shehatah EN. A Comparative Study between Appendicitis Inflammatory Response Score and Alvarado Score in The Diagnosis of Acute Appendicitis. The Egyptian Journal of Hospital Medicine. 2018;73 (8):7317-22.
51. Anwar HW, Elsayed AM, Ahmed HS. Comparative Study between Alvarado Score and Appendicitis Inflammatory Response Score in Diagnosis of Acute Appendicitis. The Egyptian Journal of Hospital Medicine. 2018;72(2):3904-8.
52. Humes DJ, Simpson J. Acute appendicitis. BMJ. 2006;333:530-4.
53. Davies HO, Alkhamesi NA, Dawson PM. Peritoneal fluid culture in appendicitis: review in changing times. Int J Surg. 2010;8:426-9.
54. Nanjundaiah N, Mohammed A, Shanbhag V, Ashfaque K, Priya SA. A Comparative Study of RIPASA Score and ALVARADO Score in the diagnosis of acute appendicitis. J Clin Diagn Res. 2014;8:NC03-5.
55. Kalan M, Talbot D, Cunliffe WJ, Rich AJ. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: a prospective study. Ann R Coll Surg Engl. 1994;76:418-9.
56. Livingston EH, Woodward WA, Sarosi GA, Haley RW. Disconnect between incidence of non perforated and perforated appendicitis: implications for pathophysiology and management. Ann Surg. 2007;245:886-92.
57. Selbst SM, Friedman MJ, Singh SB. Epidemiology and etiology of malpractice lawsuits involving children in US emergency departments and urgent care centers. Pediatr Emerg Care. 2005;21:165-9.
58. Sulu B, Gunerhan Y, Palanci Y, Isler B, Caglayan K. Epidemiological and demographic features of appendicitis and infuences of several enviornmental factors. Turk J Trauma Emerg Surg. 2010;16(1):38-42.

59. Kariman H, Shojaee M, Sabzghabaei A, Khatamian R, Derakhshanfar H, Hatamabadi H. Evaluation of the Alvarado score in acute abdominal pain. Ulus Travma Acil Cerr Derg. 2014;20(2):86-90.
60. Kim BS, Ryu DH, Kim TH, Jeong U, Song JH, Cho SI, et al. Diagnosis of acute appendicitis using scoring system: compared with the Alvarado score. J Korean Surg Soc. 2010;79(3):207-14.
61. Man E, Simonka Z, Varga A, Rárosi F, Lázár G. Impact of the Alvarado score on the diagnosis of acute appendicitis: comparing clinical judgment, Alvarado score, and a new modified score in suspected appendicitis: a prospective, randomized clinical trial. Surg Endosc. 2014;28:2398-405.
62. Altman DG, Bland JM. Diagnostic tests. 1: sensitivity and specificity. BMJ. 1994;308:1552.
63. Sedighi I. Interpretation of diagnostic tests: likelihood ratio vs. predictive value. Iran J Pediatr. 2013;23:717.
64. Kharbanda AB, Monuteaux MC, Bachur RG, Dudley NC, Bajaj L, Stevenson MD, et al. A clinical score to predict appendicitis in older male children. Acad Pediatr. 2017;17:261-6.

S.NO.	MRD NO	AGE	SEX	VOMITING	Pain in right lower quadrant	MUSCULAR DEFENCE			Body temperature >38.5^{0}C (1)	Polymorphonuclear leucocytes		WBC		CRP estimation		AIR SCORE	HISTOPATHOLOGICAL DIAGNOSIS
						LIGHT (1)	MEDIUM (2)	STRONG (3)		70-84% (1)	≥85% (2)	10000-14999 cells/cumm (1)	≥15000/cumm (2)	10-49 mg/l (1)	≥50 mg/l (2)		
1	686819	13	M	1	1		1		1	2		2		2		10	POSITIVE
2	626141	38	M	1	1		2		0	1		1		0		6	POSITIVE
3	419640	48	M	1	1		1		1	1		2		1		8	POSITIVE
4	679559	15	M	0	1		1		1	0		1		1		5	POSITIVE
5	552367	8	M	1	1		1		1	2		2		1		9	POSITIVE
6	675202	12	M	0	1		1		0	1		1		1		5	NEGATIVE
7	506605	54	M	1	1		2		0	1		0		1		6	POSITIVE
8	522143	35	M	1	1		1		0	0		1		1		5	POSITIVE
9	547108	28	M	1	1		1		1	2		1		1		8	POSITIVE
10	491247	37	F	1	1		1		1	1		1		1		2	NEGATIVE
11	530598	10	M	1	1		1		1	1		2		2		9	POSITIVE
12	655814	35	M	0	1		1		0	0		1		1		4	POSITIVE
13	758983	7	F	1	1		2		1	1		2		2		10	POSITIVE
14	693406	26	M	1	1		1		0	0		0		0		2	POSITIVE
15	265647	18	M	0	1		2		1	1		0		2		8	POSITIVE
16	706646	63	M	0	1		2		1	0		2		2		9	POSITIVE
17	487107	26	M	0	1		1		0	1		1		1		4	NEGATIVE
18	687444	38	F	1	1		0		0	1		1		0		3	POSITIVE
19	687332	45	M	1	1		1		1	2		1		1		9	POSITIVE
20	691293	48	M	1	1		0		0	1		1		1		5	POSITIVE
21	464743	60	M	1	1		1		1	1		1		1		6	POSITIVE
22	245374	54	M	0	1		1		1	1		1		1		6	POSITIVE
23	679766	47	M	1	1		0		0	0		1		0		2	POSITIVE
24	752598	22	M	1	1		1		1	1		2		1		8	POSITIVE
25	615498	15	M	1	1		1		1	1		2		2		9	POSITIVE
26	394542	14	M	1	1		1		1	2		1		1		8	POSITIVE
27	581547	27	F	0	1		1		1	1		1		0		5	NEGATIVE
28	600795	30	M	1	1		1		1	1		1		1		7	POSITIVE
29	714617	35	M	1	1		1		1	0		0		0		3	POSITIVE
30	437755	23	M	0	1		1		1	1		2		1		8	POSITIVE
31	457074	65	F	1	1		1		0	1		1		0		3	NEGATIVE
32	674637	12	F	1	1		0		0	1		1		0		3	POSITIVE
33	523696	60	M	1	1		1		1	1		1		1		7	POSITIVE

S.NO.	MRD NO	AGE	SEX	VOMITING	Pain in right lower quadrant	MUSCULAR DEFENCE			Body temperature >38.5^{0}C (1)	Polymorphonuclear leucocytes		WBC		CRP estimation		AIR SCORE	HISTOPATHOLOGICAL DIAGNOSIS
						LIGHT (1)	MEDIUM (2)	STRONG (3)		70-84% (1)	≥85% (2)	10000-14999 cells/cumm (1)	≥15000/cumm (2)	10-49 mg/l (1)	≥50 mg/l (2)		
34	744333	50	F	1	1		2		0	1		2		1		8	POSITIVE
35	191149	58	M	1	1		0		0	1		1		1		5	POSITIVE
36	646961	60	M	1	1		1		0	1		1		1		6	POSITIVE
37	608564	25	M	1	1		2		1	1		2		2		9	POSITIVE
38	393298	74	M	0	1		1		0	1		2		2		3	NEGATIVE
39	541852	47	F	1	1		1		1	1		1		1		7	POSITIVE
40	755917	38	F	1	1		1		1	1		2		2		9	POSITIVE
41	520118	50	M	1	1		0		1	1		1		1		6	POSITIVE
42	440439	50	M	1	1		2		1	1		1		1		8	POSITIVE
43	368805	24	M	1	1		1		0	0		1		1		5	NEGATIVE
44	501423	23	M	1	1		3		1	1		1		1		10	POSITIVE
45	437701	40	M	0	1		1		1	1		1		1		7	POSITIVE
46	738483	37	M	0	1		0		0	1		1		1		3	POSITIVE
47	512053	32	F	0	1		1		1	1		1		0		5	NEGATIVE
48	730087	65	M	1	1		0		0	1		1		1		6	POSITIVE
49	666033	45	F	1	1		1		1	1		2		2		8	POSITIVE
50	726176	34	M	0	1		1		1	1		2		2		8	POSITIVE
51	710161	64	M	1	1		1		1	2		2		2		10	POSITIVE
52	83481	23	M	1	1		2		1	2		2		1		10	POSITIVE
53	421174	33	F	1	1		1		1	2		1		2		9	POSITIVE
54	568193	48	F	0	1		1		0	1		2		1		4	NEGATIVE
55	7437	9	F	1	1		1		1	2		2		2		10	POSITIVE
56	649757	13	M	1	1		1		1	2		2		2		10	POSITIVE
57	639281	37	M	1	1		1		1	1		1		2		8	POSITIVE
58	714617	35	M	1	1		1		1	1		1		1		7	POSITIVE
59	454434	20	M	1	1		2		1	2		2		2		11	POSITIVE
60	4164	54	M	1	1		1		1	2		2		2		10	POSITIVE
61	285278	24	M	1	1		1		0	1		1		1		4	NEGATIVE
62	159311	59	M	1	1		1		1	1		1		1		7	POSITIVE
63	677677	32	F	1	1		2		1	2		1		1		8	POSITIVE
64	485060	60	M	1	1		1		1	1		2		2		9	POSITIVE

Baba Farid University
of Health Sciences
Sadiq Road
Faridkot-151 203 (Pb). INDIA.
Phone : 01639-256232,256236
Tele/Fax : 01639-256235
Email – Examination@bfuhs.ac.in

No. BFUHS/2K18p-TH/ 157-8

Date 12/10/18

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 31.08.2018 has approved the plan of thesis of Palak Gupta, a student of your college for **MS General Surgery** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Evaluation of appendicitis inflammatory response score for acute appendicitis

Supervisor
Dr. Chiranjiv Singh Gill
Prof.,
Dept. of Surgery,
DMCH, Ludhiana.

Co-Supervisor
Dr. Varun Gupta
Assoc. Prof.,
Dept. of Surgery,
DMCH, Ludhiana..

The student may submit the four copies of thesis, to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She may be directed to attach a photocopy of this letter with the forwarding letter while submitting thesis in the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic, if any.

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

27. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
28. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

M.S.

in

Surgery

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES
FARIDKOT

JANUARY, 2018

DR. PALAK GUPTA

DEPARTMENT OF SURGERY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS
For the degree of	M.S. General Surgery
Name of the candidate	Dr. Palak Gupta
Supervisor	Dr. Chiranjiv Singh Gill, Professor, Department of Surgery, DMCH, Ludhiana
Co-supervisor	Dr. Varun Gupta, Associate Professor, Department of Surgery, DMC&H, Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Acute Appendicitis, IS the most common surgically correctable cause of abdominal pain, the diagnosis of which remains difficult in many instances and IS essentially clinical. However a decision to operate based on clinical suspicion can lead to removal of normal appendix in 15-30% cases. Several diagnostic scoring systems have been devised as an aid to early diagnosis of acute appendicitis. This present study is attempted to evaluate the efficiency of appendicitis inflammatory response score in the pre-operative diagnosis of acute appendicitis.

Aim of Study: To study the efficacy of appendicitis inflammatory response score in the diagnosis of acute appendicitis and its correlation with the operative and histopathological findings.

Materials & Methods: A prospective comparative study was design. 30 patients presenting with pain in the right lower quadrant of abdomen, who after clinical examination were provisionally diagnosed to have acute appendicitis and warranted surgery for the same.

Clinical Significance: This study externally validates the AIR score for patients with acute appendicitis and can help in decreasing the rate of negative appendectomy.

Keywords: Appendicitis, inflammatory, operative, histopathological

(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS"** exist in the Department of Surgery, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate herself under our supervision and guidance.

Supervisor

Dr. Chiranjiv Singh Gill
Professor
Department of Surgery
DMCH, Ludhiana

Co-Supervisor(s)

Dr. Varun Gupta
Associate Professor
Department of Surgery
DMCH, Ludhiana

Dr. Jaspal Singh
Professor & Head
Department of Surgery
DMCH, Ludhiana

Place : _____

Date : _____

APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Palak Gupta
Department	Surgery
Topic of Thesis	EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS
Likely date of appearing in PG examination	MAY 2020
Date of enrollment	1st May, 2017
Name of Head of Department	Dr. Jaspal Singh
1) Supervisor **2) Co-Supervisor(s)**	Dr. Chiranjiv Singh Gill Dr. Varun Gupta
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
1. HOD Pharmacology	1. HOD Physiology
2. HOD Surgery	2. HOD Pathology
3. HOD Pathology	3. HOD Pharmacology
4. HOD Medicine	4. HOD SPM
5. Dean Academics	5. HOD Medicine
6. Vice Principal	6. HOD Surgery
	7. HOD Obst. & Gynae
	8. Legal Expert
	9. Secretary, IEC
	10. Dean Academics
	11. Vice Principal
	12. Principal

Approved : (Yes) / No

Chairperson
Research Committee

Chairperson
Research Committee

Approved : (Yes) / No

Chairperson
Ethics Committee

Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	Dr. Palak Gupta Aayat 7. lane -2 lower mall Kapurthala Punjab
2	NAME OF THE INSTITUTE	Dayanand Medical College & Hospital
3	COURSE OF STUDY AND SUBJECT	SURGERY (MS)
4	DATE OF ADMISSION OF COURSE	1st May, 2017
5	TITLE OF THE TOPIC	EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS"

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Acute appendicitis continues to be the most common surgical problem till date and its diagnosis is still a problem. It remains a challenge and reminder of the art of surgical diagnosis. This is demonstrated by the high negative laparotomy rates documented in the literature. A study performed in 2005 in the Netherlands found that approximately 15% of the patients underwent a negative appendectomy, a number similar to another large Swedish study.[1-5] It is safe to assume that the negative laparotomy rate declined to approximately 10% with that routine use of have had an even greater effect on the negative laparotomy rate, which has decreased even further to 5-10%.[4,5] In many European countries, most surgeons still consider acute appendicitis to be a clinical diagnosis and do not routinely perform imaging studies.[6-10] Scoring systems have been designed to aid in the clinical assessment of patients with acute appendicitis. The Alvarado score is the most well-known and best performing in validation studies, but it has some drawbacks.[7-9] Its construction was based on a review of patients who had been operated with suspicion of appendicitis, whereas the score is supposed to be used on all patients with suspicion of appendicitis. Furthermore, the score does not incorporate C-reactive protein (CRP) as a variable although many studies have shown the importance of CRP in the assessment of patients with appendicitis.[11-15] The recently introduced appendicitis inflammatory response (AIR) score was designed to overcome these drawbacks.[11] This score incorporated the CRP value in its design and was developed and validated on a prospective cohort of patients with suspicion of

acute appendicitis.[10] The objective of the present study was to evaluate the AIR score on a consecutive cohort of patients with suspicion of acute appendicitis.

Appendicitis inflammatory response score

This system consists of:

2-symptoms, 1-sign and 4- laboratory values scored as follows.

AIR score	
Vomiting	1
Pain in right lower quadrant	1
Muscular defence	
Light	1
Medium	2
Strong	3
Body temperature >38.5 °C	1
Polymorphonuclear leucocytes	
70-84%	1
Equal or more than 85%	2
WBC	
10000-14999 cells/cumm	1
Equal or more than 15000/cumm	2
CRP estimation	
10-49 mg/l	1
Equal or more than 50 mg/l	2

6.2 REVIEW OF LITERATURE

Greek voitre offerings have been found in cos and onidos, which represented the coils of intestine on which crude effort has been made to represent appendix.

Aryateus of cappedocia, in 3rd centuary AD is reported to have described accurately appendicular abscess and cured the patient by incision and draianage through the abdominal wall.

The appendix was first described by the physician, anatomist Berengario Da Carpi in 1521. Appendix was clearly depicted in the anatomical drawings of Leonardo da vinci, made in 1492, but published in 18th century. "Defabrica Corporis Humani Fabrica" published in 1543 by Andres Versalius has illustrated normal appendix.

Morgagni in 1719 published a detailed account of appendix, its site and relations in his "Achersaia anatomica". Verneys in 1710, coined the term "vermiform appendix", vermiform meaning worm like. Lieberkuhn in 1739 described the mucosal crypts which now bear his name. Weibrucht described a valve situated at the junction of appendix and caecum in 1749. Lorenz Hiester in 1711 described a perforated appendix with abscess on autopsy.

In 1827 Francois Melier, a French physician, expounded Villermay's work. He reported 6 autopsy cases of acute appendicitis and was first to suggest the antemortem recognition of acute appendicitis12. This work was discounted by many physicians of the era, including Baron Gulliaume Dupytren. Dupytren believed that inflammation of the cacum was the main cause of the right lower quadrant pathology. The term typhlitis or perityphlitis was used to describe right lower quadrant inflammation.

Reginald Fitz, a professor of pathological anatomy at Harvard, is credited for coining the term appendix. His landmark paper definitely identified the appendix as the primary cause of right lower quadrant inflammation.[13]

The greatest contributor in the treatment of appendicitis is Charle's Mc Burney. In 1889, he published his landmark paper in the NewYork medical journal describing the indications for early laparotomy for the treatment of appendicitis. It is in this paper that he described Mc Burney's point of maximum tenderness.[14] Mc Burney subsequently published a paper in 1894 describing the incision that bears his name. However Mc Burney later credited Mc Arthur with first describing this incision.[15]

In 1902, Dr A. J. Oschner published a handbook on appendicitis, in which he advocated non-operative management for spreading peritonitis by keeping the patient nil orally, gastric lavage and nutrient enemas to allow peritonitis to localize and permit a safer surgery.

Herrington, Weir and Fowler described medial extension of grid-iron incision by dividing the lateral portion of rectus sheath known as Fowler-Weir extension.

Rockey and Davis described the transverse skin incision by splitting the muscle in the direction of its fibres.

In 1902 Sir Fredrick Treves operated upon King Edward III for appendicitis successfully few days before his coronation. It was one of the most famous cases of appendicectomy and did much to popularize the operation.

Attempts to sterilize the appendix stump with chemicals or cautery became popular early and are still employed by surgeons.

Increased understanding of the pathophysiology of peritonitis, fluid resuscitation and antibiotic therapy in early 1940's decreased the mortality rate.

In 1965 Brooke and Keller described radiological signs of acute appendicitis. In 1978, Gastro reported 3 cases of pneumoperitoeum. Haker DA et al, described the use of laparoscopy in the diagnosis of acute appendicitis in young women.

Semm is credited with performing the first successful laparoscopic appendicectomy in 1982

Daehlin L et al (1982): A high degree of alertness seems to be essential for the early diagnosis of acute appendicitis in this age group.[16]

Butchman T G (1984) et al: Any patient observed for an ostensibly non-surgical condition of the abdomen who fails to improve markedly during a brief course of appropriate specific or supportive therapy must be re-evaluated as a potential surgical candidate. Despite the proliferation of accessible lab tests and imaging procedures, the early diagnosis of acute appendicitis rests upon the clinical skills of the physician. A high index of suspicion is crucial.[17]

Arbjornsson E (1985): Using the scoring system described, 30% of the unnecessary appendicectomies could have been avoided.[18]

Alvarado A (1986): gave a practical score for the early diagnosis of acute appendicitis. Its construction was based on a review of patients who had been operatedwith suspicion of appendicitis, whereas the score is supposed to be used on all patients with suspicion of appendicitis. Also, the score does not incorporate C-reactive protein as a variable, although many studies have

shown the importance of C-reactive protein in the assessment of patients with appendicitis.[19]

The recently introduced appendicitis inflammatory response (AIR) score was designed to these drawbacks. This score incorporated the C-reactive protein value in its design and was developed and validated on a prospective cohort of patients with suspicion of acute appendicitis.

6.3 AIMS AND OBJECTIVES OF THE STUDY

To study the efficacy of appendicitis inflammatory response score in the diagnosis of acute appendicitis and its correlation with the operative and histopathological findings.

7. MATERIALS AND METHODS

The period of the study is one-and-a-half-year from 1 Jan 2018 to 30th June 2019. All patients, with the provisional diagnosis of Acute Appendicitis admitted in the wards and emergency in the department of surgery in the hospital Dayanand Medical College & Hospital, Ludhiana.

7.1 Source of Data

All patients, with the provisional diagnosis of Acute Appendicitis admitted in the wards and emergency in the department of surgery in the hospital Dayanand Medical College & Hospital, Ludhiana.

7.2 METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA

Patients with provisional clinical diagnosis of acute appendicitis.

EXCLUSION CRITERIA

Patients presenting with non-right iliac fossa pain and those who had been admitted by other specialties for other complaints but subsequently developed right iliac fossa pain.

METHODS OF COLLECTION

Patients of any age group and both genders presenting to the surgery department with pain in right lower quadrant of abdomen presenting with symptoms & signs of acute appendicitis were included in the study. All included patients admitted, initially were subjected for detailed history taking which includes symptoms & duration of the disease; General Physical Examination & Systemic Examination. Base-line investigations (full blood count, urine routine examination, USG Abdomen was done. Then a specially designed proforma was filled in for each patient. These proforma had general

information about the patients, plus eight variables based on the Appendicitis inflammatory response score. Then the sum of all the scores are calculated for each patient Diagnosis of acute appendicitis was confirmed by operative findings and histopathological assessment of the appendicectomy specimen. Finally the reliability of Appendicitis inflammatory response score system was assessed by the intraoperative and histopathological findings. The findings were compared retrospectively with the Appendicitis inflammatory response score.

NUMBER OF CASES

The period of the study is one-and-a-half-year from 1 Jan 2018 to 30th June 2019.

OUTCOME

1. This study will reduce the rate of negative appendectomy.
2. The peripheral areas where the resources of imaging is not available this score will help in the diagnosis of acute appendicitis.
3. In patients who AIR score is equivocal, the other possibilities shall be kept.

STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. The sensitivity and specificity will be calculated for the appendicitis inflammatory response score by comparing with the biopsy report after surgery.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

Yes, patients presenting included in the study will have to undergo hematological, biochemical, radiological investigations. For this patients included in the study will be informed regarding their inclusion and written informed consent will be taken for all the patients included in the study. These are however, essential for the patient management and are a part of the routine protocol for the management for stoma closure.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached herewith.

LIST OF REFERENCES

1. Seal A. Appendicitis: A historical review. Can J Surg. 1981;24:427-33.
2. Andersson RE, Hugander A, Thulin AJ. Diagnostic accuracy and perforation rate in appendicitis: Association with age and sex of the patient and with appendicectomy rate. Eur J Surg. 1992;158:37-41.
3. Hale DA, Molloy M, Pearl RH, Schutt DC, Jaques DP. Appendectomy: A contemporary appraisal. Ann Surg. 1997;225:252-61.
4. SCOAP Collaborative, Cuschieri J, Florence M, Flum DR, Jurkovich GJ, Lin P, et al. Negative appendectomy and imaging accuracy in the Washington state surgical care and outcomes assessment program. Ann Surg. 2008;248:557-63.
5. Wagner PL, Eachempati SR, Soe K, Pieracci FM, Shou J, Barie PS. Defining the current negative appendectomy rate: For whom is preoperative computed tomography making an impact? Surgery. 2008;144:276-82.
6. Poortman P, Oostvogel HJ, de Lange-de Klerk ES, Cuesta MA, Hamming JF. The use of imaging in the case of suspected acute appendicitis: Opinion of Dutch surgeons. Ned Tijdschr Geneeskd. 2009;153:B376.
7. Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med. 1986;15:557-64.
8. Owen TD, Williams H, Stiff G, Jenkinson LR, Rees BI. Evaluation of the Alvarado score in acute appendicitis. J R Soc Med. 1992;85:87-8.
9. Douglas CD, Macpherson NE, Davidson PM, Gani JS. Randomised controlled trial of ultrasonography in diagnosis of acute appendicitis,

incorporating the Alvarado score. BMJ. 2000;321:919-22.

10. Andersson RE. Meta-analysis of the clinical and laboratory diagnosis of appendicitis. Br J Surg. 2004;91:28-37

11. Andersson M, Andersson RE. The appendicitis inflammatory response score: A tool for the diagnosis of acute appendicitis that outperforms the Alvarado score. World J Surg. 2008;32:1843-9.

12. Ellis H. Appendix, in Schwartz SI(ed): Maingot's abdominal operations, 8th end Vol. 2 Norwalk: Appleton-century - crofts 1985 P 1255.

13. Fitz RH. Perforating inflammation of the vermiform appendix with special reference to its early diagnosis and treatment. Am J Med Sci. 1886;92:321–46.

14. McBurney C. Experience with early operative interference in cases of disease of the vermiform appendix. NY Med J. 1889;50:676–84.

15. Mc Burney C. The incision made in the abdominal wall in cases of appendicitis. Ann Surg. 1894;20:38.

16. Daehlin L. Acute appendicitis during the first three years of life; Acta Chir Scand. 1982;148(3):291-94.

17. Butchman TG, Zuidema GD. Reasons for delay of the diagnosis of acute appendicitis; Surg Gynaecol Obstet. 1984;158(3):260-6.

18. Arbjornsson E. Scoring system for computer aided diagnosis of acute appendicitis: the value of prospective vs retrospective studies: Ann Chir Gynaecol. 1985;74(4):159-66.

19. Andersson M, Andersson RE. The appendicitis inflammatory response score: a tool for the diagnosis of acute appendicitis that outperforms the Alvarado score. World J Surg. 2008;32:1843-9.

PROFORMA

NAME: Sr. NO. :

MRD NO:

AGE : SEX:

DOA : DOD :

COMPLAINTS :

- PAIN ABDOMEN
- ANOREXIA
- NAUSEA/VOMITING
- FEVER
- OTHERS-

LOOSE STOOLS	YES/NO
FREQUENCY OF MICTURATION	YES/NO
BURNING MICTURATION	YES/NO
HAEMATURIA	YES/NO
TESTICULAR PAIN	YES/NO
PAIN DURING PERIODS	YES/NO
MISSED PERIODS	YES/NO
PER VAGINAL WHITE DISCHARGE	YES/NO

Signature of Candidate **Signature of Supervisor**

EXAMINATION OF ABDOMEN

1. INSPECTION

1. SHAPE OF ABDOMEN : NORMAL/ABNORMAL
2. ABDOMINAL WALL MOVEMENT WITH RESPIRATION IN LOWER PART : DIMINISHED/NOT DIMINISHED
3. INGUINAL ORIFICES :
4. EXTERNAL GENITALIA :

2. PALPATION

a. TENDERNESS :

1. TENDERNESS IN RIGHT ILIAC FOSSA YES/NO
2. REBOUND TENDERNESS YES/NO
3. ROVSING'S SIGN YES/NO
4. COPE'S PSOAS TEST YES/NO
5. OBTURATOR'S TEST YES/NO

b. MUSCULAR GAURDING/RIGIDITY YES/NO

3. PERCUSSION

1. SHIFTING DULLNESS YES/NO
2. FLUID THRILL YES/NO

c. OBLITERATION OF LIVER DULLNESS YES/NO

4. AUSCULTATION:

1. BOWEL SOUNDS : PRESENT/ABSENT
2. PR EXAMINATION :
3. PV EXAMINATION :
4. TENDERNESS IN RECTOVESICAL / RECTOVAGINAL POUCH ON RIGHT SIDE : YES/NO

Signature of Candidate **Signature of Supervisor**

EXAMINATION OF OTHER SYSTEMS:

1. CARDIO VASCULAR SYSTEM
2. RESPIRATORY SYSTEM
3. CENTRAL NERVOUS SYSTEM

INVESTIGATIONS:

1. BLOOD INVESTIGATION:

1. HB%
2. TOTAL WBC COUNT
3. DLC -

N- , L- , E- , M- , B-

2. BIOCHEMISTRY:

1.RBS

2..SERUM CREATININE

3.CRP

3. VIRAL MAKERS-

- HIV-
- HBSAG-
- HCV-

4. ULTRASOUND ABDOMEN -

5. CHEST XRAY-

6. ECG-

PRE OPERATIVE DRUG TREATMENT :

1. INTRA VENOUS FLUIDS
2. ANTIBIOTICS
3. ANALGESICS

Signature of Candidate **Signature of Supervisor**

PREPARATION :

WRITTEN INFORMED CONSENT : YES/NO

OPERATION :

SURGEON

ANAESTHETIST

DATE :

PERIOPERATIVE ANTIBIOTICS:

POST OPERATIVE COMPLICATION:

1. WOUND INFECTION YES/NO
2. INTRA ABDOMINAL ABSESS YES/NO
3. ILEUS YES /NO
4. VENOUS THROMBOSIS YES/NO
5. FAECAL FISTULA YES/NO

HOSPITAL STAY:

HISTOPATHOLOGICAL REPORT FINDINGS:

APPENDCITIS INFLAMMATORY RESPONSE SCORE.

1. VOMITING

2. PAIN IN RIGHT LOWER QUADRANT

3. MUSCULAR DEFENCE

a) LIGHT

b) MEDIUM

c) SEVER

4. BODY TEMPERATURE >38.5 C

Signature of Candidate **Signature of Supervisor**

5.POLYMORPHONUCLEAR LEUCOCYTES

a) 70-84%

b) EQUAL OR MORE THAN 85%

6. WBC

a) 10000-14999 CELLS/CUMM

b) EQUAL OR MORE THAN 15000/CUMM

7. CRP ESTIMATION

a) 10-49 MG/L

b) EQUAL OR MORE THAN 50 MG/L

1. **0-4=low probability**
2. **5-8=mild probability**
3. **9-12=high probability**

DIAGNOSIS :

Signature of Candidate **Signature of Supervisor**

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o.....

am willing to participate in the study **"EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

.....
Signature of the Witness

Name:

.....
Signature of the patient

Signature of Candidate

Signature of Supervisor

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य **"EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"EVALUATION OF APPENDICITIS INFLAMMATORY RESPONSE SCORE FOR ACUTE APPENDICITIS" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____
ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ

_____
ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____

ਮਿਤੀ_____

ਪਤਾ _____

ਪਤਾ _____

_____
ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____
ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ